

Very Highly Charged Ions like Au^{69+} : A New Tool for Surface Analysis

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The interaction of slow ($v \ll v_{\text{Bohr}}$), highly charged ions with surfaces is characterized by a dominance of electronic over collisional effects. A single Au^{69+} ion deposits a total potential energy of ~ 160 keV into a nanometer sized near surface volume when it neutralizes at its impact on a surface. The energy density of such a neutralization process is much higher than corresponding near surface nuclear and electronic energy losses of conventional singly charged ions. Consequently, secondary electron- and ion production rates are increased by two orders of magnitude in highly charged ion based secondary electron microscopy and SIMS. Substantial useful yield increases in highly charged ion based TOF-SIMS could result in drastically improved sensitivity limits for the detection of surface impurities beyond the current limits of $\sim 10^8 - 10^9$ at/cm².

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